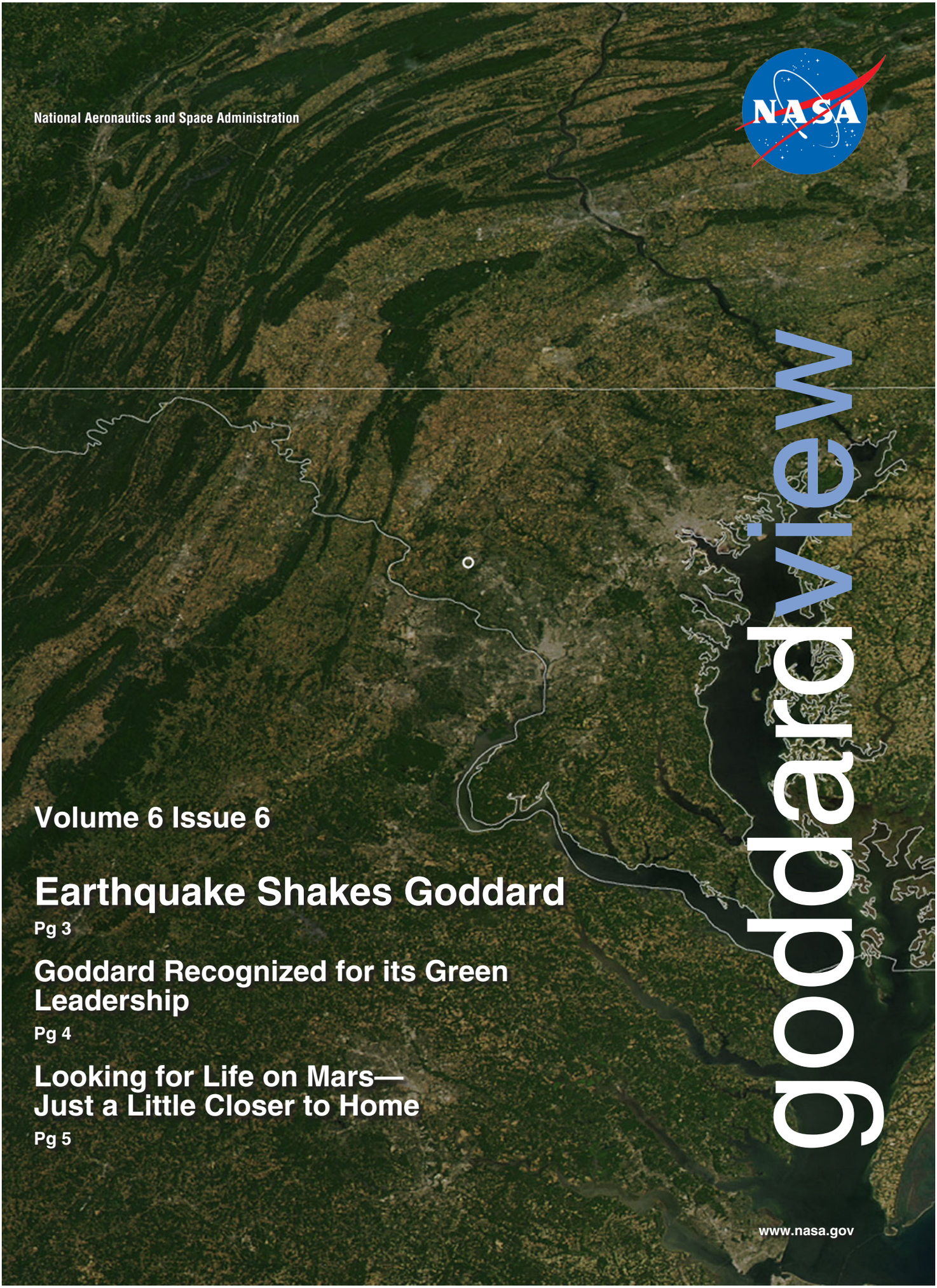

National Aeronautics and Space Administration

goddardview

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i am goddard: David Long

By Judith Clark

David Long was surprised when asked to represent "Get Involved" in the kickoff for the "i am goddard" campaign. "You know, I am not a star," was his initial response—but that was precisely the point. "i am goddard" is a celebration of the many individual contributions that help make the Agency successful, and David is a great example.

David began his career with Goddard as an intern in 2004, transitioned into the Co-op Program in 2005, and joined Goddard full-time in 2007. As a resource analyst, David manages the finances for grants awarded by NASA's Earth Science Technology Office (ESTO). He works with universities, industry, and other NASA Centers overseeing technology developmental projects.

David Long also likes to participate in activities outside of his day-to-day job functions. "Currently, my job entails working with spreadsheets, but I also have a creative side. Getting involved outside of my organization gives me another perspective and allows me to contribute to the Center in other ways. As a result, I have learned new skills, reached out and met new people, and been able to apply some of my creative talents."

David is an active member of the Asian Pacific American Advisory Committee (APAAC). He has also helped organized the Code 400 Peer Awards. He submitted this year's Celebrate Goddard Day theme: Goddard—Uniting People, Understanding our World. And David keeps in touch with his alma mater—Baruch College of the City University of New York.

Since being featured on the "Get Involved" poster, David has been recognized across the Center. "It's been pretty cool. Getting involved only opens doors and creates opportunities. It ultimately contributes to career satisfaction."

David Long: ESTO resource analyst; CUNY graduate; finance and investments major; Chinese, Filipino, and Spanish descent; grew up in West Virginia; *Star Trek* enthusiast; oil painter; actor; violinist; husband; cookie-dough ice cream lover. ■

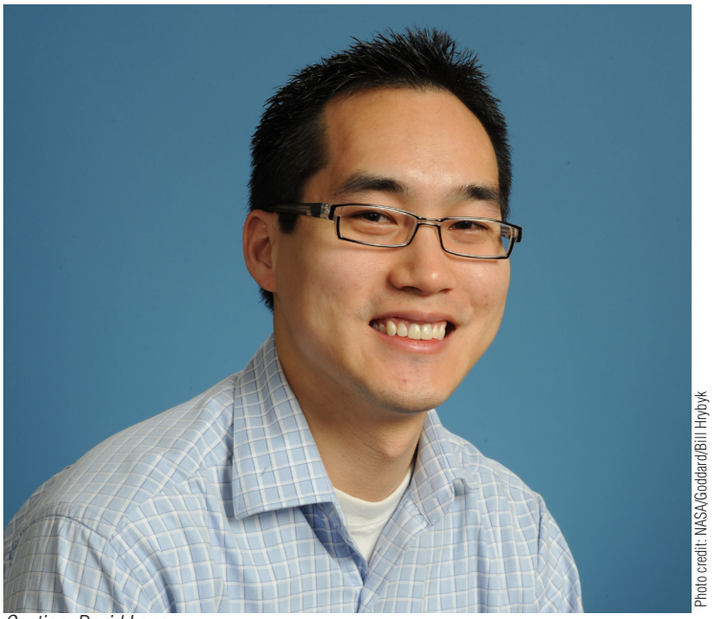

Photo credit: NASA/Goddard/Bill Hrybyk

Caption: David Long.

GoddardView

Volume 6 Issue 6

Table of **Contents**

On the cover: Visible image of Maryland as seen by the Moderate Resolution Imaging Spectroradiometer (MODIS) on the *Terra* satellite. The small circle near the center of the image indicates the area of the earthquake's center.

Photo credit: NASA

GoddardView Info

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Editor: John Putman

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Earthquake Shakes Goddard

By Rob Gutro

A small earthquake, centered in Germantown, Md. occurred at 5:04 a.m. EDT, July 16. Its vibrations were felt from West Virginia to Bridgeport, Conn. Goddard lies about 25 miles east-southeast of the small earthquake's epicenter and reported no damages. In fact, there were no reports of damage throughout Maryland.

The earthquake registered 3.6 on the Richter scale according to the U.S. Geological Survey (USGS), the agency that monitors quakes around the U.S. The quake originated 5 kilometers (3.1 miles) deep and was centered at 39.167°North, 77.252°West, in Germantown, Md. That latitude and longitude positions the quake's epicenter just west of Interstate 270 and south of Maryland state route 119.

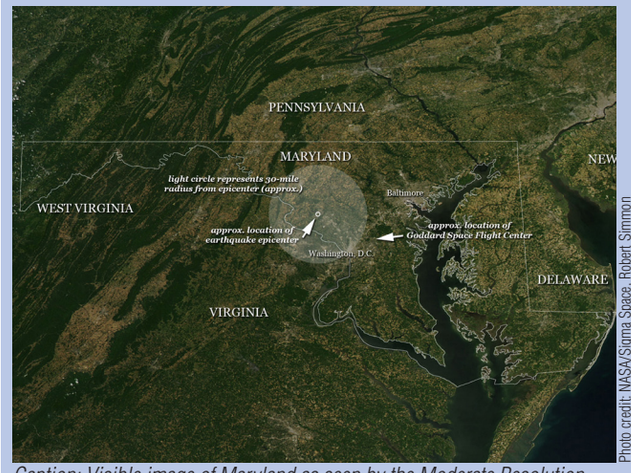

Photo credit: NASA/Sigma Space, Robert Simmon

Caption: Visible image of Maryland as seen by the Moderate Resolution Imaging Spectroradiometer (MODIS) on the Terra *satellite. The circle indicates the area of the earthquake's center.*

The USGS noted that the epicenter was 15 km (10 miles) northwest of Rockville, Md., 30 km (15 miles) east-northeast of Leesburg, Va., 35 km (20 miles) northwest of Washington, D.C., and 70 km (45 miles) west-northwest of Annapolis, Md.

Although earthquakes are monitored by the U.S. Geological Survey, NASA conducts research in various earthquake projects. That research is done in earthquake country, however, at NASA's Jet Propulsion Laboratory in Pasadena, Calif., just outside of Los Angeles. NASA measures, computes, and models crustal deformation using GPS and Interferometric Synthetic Aperture Radar (InSAR) from its airborne unmanned aerial vehicle (UAV) SAR platform and international satellites.

"Crustal deformation occurs both as a result of earthquakes and quietly," said Andrea Donnellan, a geophysicist at NASA's Jet Propulsion Laboratory in Pasadena, Calif., a research professor at the University of Southern California, and NASA's Applied Sciences Program Area Co-Lead for Natural Disasters. "The quiet or aseismic motions provide insight into the processes that produce earthquakes. GPS data provide daily precise positions of points or stations on the ground, which in turn provide a detailed time history of crustal deformation and changes. InSAR provides regional images of crustal deformation."

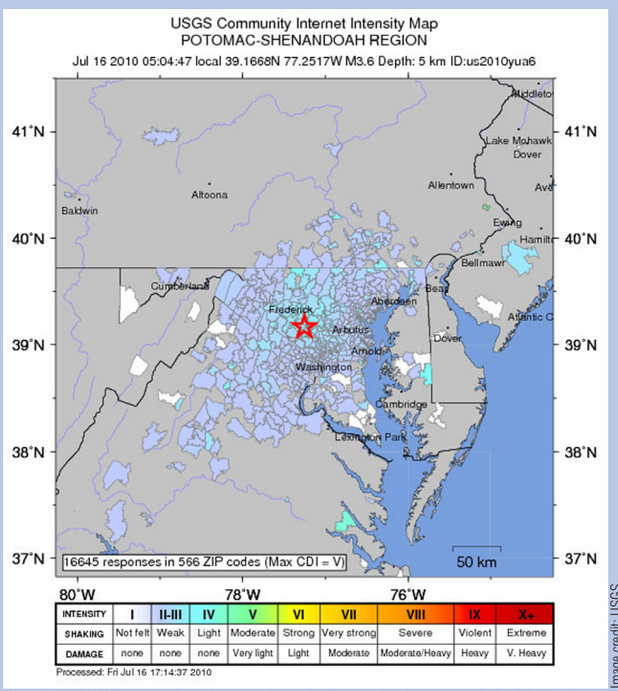

Image credit: USGS

Caption: USGSmap showing earthquake intensity from the July 16 earthquake centered near Germantown, Md. (depicted by the star). Light blue areas indicate weak vibrations felt in various areas surrounding the quake.

NASA funds several projects that integrate the GPS and InSAR data into models that provide insight into fault activity and earthquake potential, and Donnellan is the Principal Investigator of NASA's QuakeSim project, as well as supercomputing, earthquake modeling, and UAVSAR projects.
The last earthquake in the region occurred in May of 2008 and was even smaller, registering a magnitude of 2.0 on the Richter Scale.

The USGS has a Web site where you can report what you felt during earthquake events and view a map displaying accumulated data from your report and others. See it at: http://earthquake.usgs.gov/earthquakes/dyfi/events/us/2010yua6/us/index.html. ■

Goddard Recognized for its Green Leadership

By Trusilla Steele

Maryland's Department of Environment has officially recognized NASA Goddard Space Flight Center's leadership in environmental stewardship as a member of Maryland's Green Registry. Goddard is the first federal facility to join the Registry and to receive the state's Green Registry Leadership Award. The award commends organizations for achieving measurable results and demonstrating a strong commitment to continue environmental sustainability and practices.

The Green Building Council in Jessup, Md. hosted an evening reception on July 6 to present the first annual Maryland Green Registry Leadership Award to Goddard and four other organizations.

Shari Wilson, Secretary of Maryland's Department of Environment (MDE); Joseph Gill, Deputy Secretary of Maryland's Department of Natural Resources and Ken Ulman, Howard County Executive presented the awards and congratulated recipients. Wilson recognized the green stewardship of NASA Goddard Space Flight Center, British American Auto Care, Inc., GM Baltimore Transmission, St. Mary's College of Maryland, and Union Hospital of Cecil County. MDE's July 7 press release noted, "…these organizations have displayed outstanding leadership through their strong commitment to environmental protection…all (recipients) have several key factors in common that contribute to their success: each organization has a green team, has organization-wide commitment to environmental performance, sets annual environmental goals, and measures their results."

Photo credit: NASA/Goddard/Lixa Rodriguez-Ramon

Caption: Phil Nessler, Goddard's Greenbelt Facility Environmental Manager (3rd from left) holds award and is pictured with Joseph Gill, Deputy Secretary of Maryland's Department of Natural Resources (far left), Shari Wilson, Secretary of Maryland's Department of the Environment, and Dominick Murray, Economic Development Deputy Secretary.

Phil Nessler, Goddard's Greenbelt facility, Environmental Manager accepted the award on behalf of Center and stated, "The great part of our (NASA Goddard) success is due to the support from Goddard employees."

Goddard continues to reduce, reuse and recycle through the Environmental Management System (EMS) that incorporates employees, procedures and policies into one overarching system. EMS enables regular outreach initiatives which engages senior management and employees and enhances awareness which induces support from employees for reducing negative environmental impacts at Goddard.

Goddard's measurable achievements occurred over several years and include becoming the first federal facility to utilize methane gas from a nearby landfill. Such gas is used in three boilers that produce steam, heating 31 buildings on Center. NASA has saved the taxpayers more than $13.8 million in fuel cost since 2003. In addition, since 2005, Goddard has reduced their waste production by 25 percent, exceeding their original goal of a 20 percent reduction by 2010. Goddard recently achieved LEED (Leadership in Energy and Environmental Design) Gold certification for the new Exploration Sciences Building, exceeding NASA's standard of achieving Silver certification.

Goddard has received funding for design and installation of a Geothermal Heat Pump system (GHP). The GHP system will use the earth's soil as the medium of heat transfer. This system will replace the HVAC units inside Building 25. The stability of the underground temperature throughout the year makes it an ideal energy source for controlling indoor temperatures and will reduce heating and cooling costs by 30 percent. Construction for the GHP project is anticipated to begin in the fall of 2010.

In addition, Facilities Management Division is installing a Free Cooling device in Building 24. This device will achieve energy savings by utilizing the cooling towers to create chilled water, whenever outside air conditions permit, in place of running the chillers. A similar device has been operating successfully in Building 31 for several years.

For more information on the Geothermal Heat Pump or to become involved, visit Goddard's Energy Management Web site, at: http://energy/geothermal.html and Goddard's Green Team at: http://recycle.gsfc.nasa.gov. ■

Looking for Life on Mars—Just a Little Closer to Home

By Lori J. Keesey

The Mars Science Laboratory (MSL) is expected to touch down on the Martian surface in 2012 to assess if Mars was in the past, or is today, capable of supporting life. But in a sense the search already has begun—just a little closer to home.

In August, three Goddard scientists who are helping develop the Sample Analysis at Mars (SAM) instrument suite—one of 11 instruments flying on MSL—will test data-gathering techniques and instruments at three sites in Svalbard, Norway, an island above the Arctic Circle that closely resembles the environment found on Mars. When SAM begins operations on the Red Planet in a couple years, it will search for carbon compounds, including methane, which are associated with life and explore ways in which they are created and destroyed in the Martian environment.

The Goddard contingent is participating in the Arctic Mars Analog Svalbard Expedition (AMASE), an international project sponsored by The Carnegie Institution of Washington, NASA, and several other international academic and research organizations. During this particular trip, scientists will deploy instruments at three sites—methane seeps at Knorringfjellet, a sediment outcrop near Ny Ålesund, and carbonate-encrusted volcanic vents at Sigurdfjellet—and operate them remotely, much like an actual mission to Mars.

"We'll be able to simulate some of the experiments we're doing on SAM to test our systems, verify, and validate some of the data we'll be getting," said Jennifer Stern, who is taking a Cavity Ringdown Spectrometer, a commercial instrument she modified in part with Goddard Internal Research and Development (IRAD) program funding.

Like SAM's Tunable Laser Spectrometer, Stern's instrument will measure the isotopic composition of carbonates that form in the presence of water and carbon dioxide. Knowing the isotopic ratios of carbon compounds can help scientists determine whether biological or abiotic processes were responsible for their formation.

An Evolved Gas Analysis Mass Spectrometer provided by Amy McAdam will support Stern's investigation and will emulate some of the tasks SAM will perform on Mars. Instead of examining carbon isotopes, McAdam's instrument will characterize rock and soil samples by monitoring the compounds released as they are heated to high temperatures. In particular, it will look for organic materials trapped within the samples.

Scientist Inge ten Kate is taking the Goddard-developed Volatile Analysis by Pyrolysis of Regolith (VAPoR), a miniaturized version of SAM that originally was developed for lunar exploration, but is suitable for investigating other airless bodies and those with thin atmospheres. The portable field instrument, developed in part with IRAD funding, will analyze gases in the atmosphere as well as vapors that are produced when its onboard oven heats soil and rock samples to at least 1,200° C (2,192° F). The oven is capable of reaching higher temperatures than SAM. The measurements could help scientists determine whether organic compounds exist in the sample.

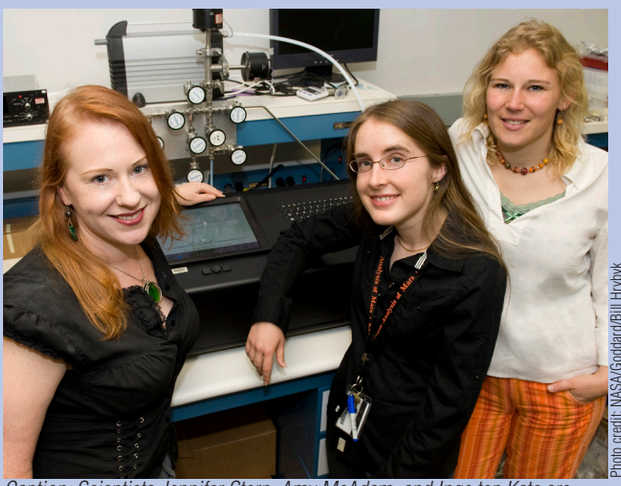

Photo credit: NASA/Goddard/Bill Hrybyk

Caption: Scientists Jennifer Stern, Amy McAdam, and Inge ten Kate are traveling to Norway in August to test data-gathering techniques and instruments in preparation for a Mars mission carrying the Goddard-developed Sample Analysis at Mars instrument suite.

Eventually, the instrument will carry a time-of-flight mass spectrometer, also developed in part with IRAD funding. The new spectrometer contains nano-constructed components that could make it more capable and much smaller than its predecessors. Ultimately, the VAPoR team hopes to win a future planetary mission, and the field campaign in Norway is designed to demonstrate the instrument's capabilities.

"I think it's a really cool opportunity," McAdam said. "The entire campaign will simulate what a real rover team would do." ■

NASA Awards the Late Dr. Timothy Hawarden for Contribution to *James Webb Space Telescope*

By Lynn Chandler

The late Dr. Timothy Hawarden was recently awarded with a NASA Exceptional Technology Achievement Medal for his pioneering work on innovative cooling techniques for future infrared space telescopes, including one that will follow the *Hubble Space Telescope*.

The award, the highest such award given by NASA, was presented at Goddard on June 16, 2010. Nobel laureate Dr. John Mather, an American astronomer who was an early convert to Hawarden's concept, accepted it on his behalf.

Photo provided by Royal Observatory, Edinburgh

Caption: Dr. Timothy Hawarden.

On July 15, Dr. Hawarden's widow, Frances, was presented a medal at a ceremony held at the Science and Technology Facilities Council's U.K. Astronomy Technology Centre (UK ATC), formerly known as the Royal Observatory, Edinburgh (ROE), where Hawarden was based for many years.

"I can recall vividly Tim's excitement when he realized in the mid-1980s that passive cooling was the way to design infrared space telescopes," said Professor Malcolm Longair, who was the Director of the ROE and Astronomer Royal for Scotland. Longair witnessed Hawarden's dedication to his new ideas firsthand throughout the 1980s. "This deep insight was before its time, but it is now the preferred method for the construction of large cooled space telescopes such as the *James Webb Space Telescope*."

Infrared telescopes in space, such as the *Webb Telescope*, must be very cold so that heat from the mirrors themselves will not overwhelm the faint light from distant astronomical sources. Hawarden's breakthrough idea was to do away with the traditional method of cooling space telescopes using huge tanks of cryogenic coolants, such as liquid helium, and instead use a combination of sun shields and radiators to allow space telescopes to lose heat passively. The heat would simply radiate away into cold space.

The advantages of this are twofold. With passive heat loss, the lifetime of a telescope is not limited by the amount of coolant that can be launched, and the telescope, including the main mirror, can be much bigger since it does not have to be encased. A larger main mirror makes it easier for the telescope to see fine detail and very faint objects.

The idea initially met with significant resistance from the space science community but gradually, and after many false starts, it began to be accepted. It was finally embraced by NASA and European Space Agency (ESA) in the designs for space telescopes such as *Spitzer* (launched August 2003 with a modified design including radiative cooling), *Herschel* (launched May 2009) and the *James Webb Space Telescope*.

"Using the insights about, and the conceptual work on, space observatories that Tim had done in the late 1980s and early 1990s, NASA, ESA, and Canadian Space Agency (CSA) are developing the world's most powerful space telescope," said Eric Smith, a *Webb Telescope* and *Hubble* program scientist at NASA Headquarters, Washington. "It's a pleasure to see the dreams of someone as beloved and respected by colleagues as Tim was coming into reality."

Professor Ian Robson, Director of the U.K. Astronomy Technology Centre at the ROE said, "This is an excellent example of a scientist, who originally was not working in this field at all, but who studied the problem and produced an innovative, left-field solution; brilliantly simple in principle and highly cost-effective in practice. We are all bowled over with pride and at the same time sadness that he is no longer with us to receive the award in person," Robson added.

Tim's widow, Frances, commented, "It's hard to express what I feel—enormous pride in Tim's contribution to science, yes, but more than this. The NASA medal is a reminder of his continuing presence in all our minds. Perhaps it is best summed up in a line from the Carmina Burana, always one of Tim's favorite pieces of music: 'sum presentialiter absens in remota'—I am with you even when I am far away. For me personally that is the highest accolade of all."

The *Webb Telescope* is a partnership between NASA, ESA, and CSA. For more information on the *James Webb Space Telescope*, visit: http://www.jwst.nasa.gov. ■

Goddard Scientist's Book Gets Mention in *New York Times*, Warns Against Geoengineering

By Christina Coleman

Since Dr. Claire Parkinson's book, "Coming Climate Crises? Consider the Past, Beware the Big Fix," made its debut back in April, the never-ending discussion on climate change has gotten even hotter.

In an attempt to curb the controversial talk of "geoengineering," roughly described as engineering techniques used to cool down the Earth, Parkinson decided to write the book to counteract the ideas after hearing a Nobel Prize-winning scientist voicing support for pouring sulfate aerosols into the air. This is sometimes described as creating an artificial volcano, similar to the 1991 eruption of Mount Pinatubo, which released some 20 million tons of sulfur-dioxide and consequently ended up cooling the globe about 0.4°C in the two years that followed.

Even though the clouded atmosphere bounced some of the Sun's radiation back into space, the natural disaster also caused further damage to the ozone layer. It didn't do much else for the world's air pollution levels either.

"The very fact that a Nobel Prize winner was coming up with an element of support made me feel like I had to say something, I can't keep quiet when this could be real. The problem is that we've poured too much in the atmosphere already," said Parkinson, a climate scientist at Goddard.

Photo credit: NASA/Goddard/Steve Graham

Caption: Goddard climate scientist Claire Parkinson, author of "Coming Climate Crises? Consider the Past, Beware the Big Fix."

Parkinson's fight is not in vain. With the geoengineering movement getting traction, advocates for traditional solutions to curtail greenhouse gases have been also been fighting for continued relevancy. Until recently, the only remedies discussed to reduce global temperatures included the use of alternate energy sources and cutting down on the amount of emissions; solutions suggested in Chapter 12 of Parkinson's book.

And last month, Parkinson made it to the front battle lines when New York Times writer Cornelia Dean featured Parkinson's book in the article, "When the Day After Tomorrow Has Come," along with three other authors who warn of the dangers and possible calamity of geoengineering.

"It's terrific that they included it. The extremely nice aspect was that there were four books reviewed that cautioned about geoengineering," Parkinson said. "It's something to be worried about. If all these books are cautioning then this can't be good. That showed consistency."

The article, which Parkinson didn't know about until a colleague sent her an email, offers insights from other scientists, professors, and a science reporter about weather modification, a history of Earth's weather, and the proposals (plus unintended consequences) of geoengineering.

"One would be to increase the amount of the Sun's radiation that gets reflected; if you increase how much gets reflected then less remains in the system," thus cooling down the planet as Parkinson explains.

The geoengineering solution? Cover a large desert with a reflective covering. Others suggest using that large reflective sheet for the ocean instead.

"That would cover up the ecosystems in the desert, that makes no sense," Parkinson said. "And think of the ecosystems in the ocean!" she added.

Another scheme is to promote plankton growth by sprinkling large amounts of iron in the ocean. Because plankton works like plants, the photosynthesis will help absorb carbon dioxide and when they die, they take it with them when they sink to the ocean floor.

"But the carbon will get stuck down instead of staying near the top where it's transformed," explained Parkinson.

In addition, the high numbers of plankton could promote higher levels of species that feed on them, throwing off the oceans ecosystem even more. This particular scheme has already received some real world experimentation and may soon be available to buyers interested in curbing carbon emissions.

Increased support for these issues will soon overflow into mainstream media and set off a large population of people who'll believe that altering the planet in these ways is a solution to cooling our planet. Parkinson suggests cutting back, but explains, "The problem is that some people feel that's not going to happen because humans won't cut back enough or they feel it's not the best way to solve the problem,"

She hopes that her mention in the New York Times, which she described as "neat," will encourage people to see the dangers associated with using engineering techniques to alter the planet in such ways.

"Hopefully, policy-makers and the general public realize that geoengineering will not be a clean-cut fix to our problems," Parkinson said. "We need to be careful." ■

Behind-the-Scenes View Shows How NASA Science Visualizer Creates Earth from Hundreds of Images

By Jennifer Shoemaker

Earth floats delicately in space, sunlight illuminating the fluid mottling of white clouds suspended over its surface. The scene, the leading sequence in a recent NASA video about ship pollution and clouds, shows our planet from a perspective only a satellite or spacecraft could provide.

However, no camera captured that image of the Earth. The reason? It's not one image. Instead, the single cloud-scattered globe is a mosaic of 298 smaller images of close-up areas of our planet meticulously stitched together by Helen-Nicole Kostis, a NASA science visualizer.

At Goddard's Scientific Visualization Studio (SVS), Kostis works as part of a team of visualizers who take raw scientific data and translate that data into visual imagery. The visuals help both scientists and the general public better understand the data NASA satellites and airborne missions provide in order to better comprehend complex phenomena invisible to the naked eye and "see" how the planet works. The imagery they create is scientifically accurate to a degree few others match.

Photo credit: NASA/Goddard

Caption: Helen-Nicole Kostis, NASA science visualizer.

Many Earth views we see in print and video are created by artistically splicing together various images from different satellite instruments, taken at different times and heights, in different wavelengths of light, and at different pixel resolutions. Using image-blending techniques, photo artists create a realistic-looking two-dimensional flat view from these disparate images. They then wrap this image layer, called a "texture," onto a sphere in a software program to create a view of Earth. While it makes for stunning imagery, the Earth depicted in these views is fictional—a hodge-podge of different images created from a great deal of artistic license.

"There is so much stuff out there showing the Earth, and it's very easy to take a texture and put it on a globe, that I think people don't know that what you see from the SVS is not just another texture," said Kostis. "It's data, accurately projected, and we take into consideration day and night, where the stars are, and the Sun. Sometimes during development, I feel like I am cruising into space."

To get a scientifically accurate Earth view for the video, Helen downloaded one day's worth of images taken from identical Moderate Resolution Imaging Spectroradiometer (MODIS) imaging instruments that fly on two different satellites. The first satellite, *Terra*, follows the morning light around the Earth, capturing images along a roughly north-south trajectory. The second satellite, *Aqua*, captures a similar view in the afternoon.

The first step in combining the hundreds of shots into a single image is to make sure they will lie correctly on the round surface of the globe. Imagers aboard the satellite return two-dimensional, rectangular images similar to what our cameras back on Earth produce. As a result of Earth's curvature, the land and ocean in the edges of the image curve away in a 2-D image. To correct the problem, SVS Director Horace Mitchell ran each image through a special software process that morphs the images' shape to lie properly when applied to the round surface.

Earth's spherical shape also creates other photographic problems. As the satellites orbit along a north-south route around Earth, the planet rotates underneath. As the planet revolves, areas near the equator rotate faster than areas near the poles. As a result, the satellite gets extra coverage of Polar Regions, while areas near the equator that are spinning faster often get missed between satellite passes.

To fix these data gaps, Kostis started with the single most important image—in this case, a morning scene of the north Pacific Ocean taken from the *Terra* satellite. Then, working out from that area, she selected images that were taken close in time and with closely matching clouds. In areas where data was sparse or the clouds had changed enough between satellite passes that the *Terra* data was a poor match, she laid in imagery from the afternoon pass of the *Aqua* satellite.

Once the planet was "woven" together, Kostis carefully scoured the resulting mosaic for areas where the stitching and weaving may have left tiny errors or holes. Then she carefully filled in those areas, taking care not to disturb the scientific data in nearby pixels. The result is a flawless flat image mosaic of the globe over a 24-hour period. Next, she wrapped the flat image mosaic—a scientifically accurate "texture"—onto a sphere representing Earth.

The finished Earth with a smooth camera sweep looked like a completed project, but it still needed a backdrop of stars, including our closest star, the Sun. While many visualizers would drop in any image of stars, the call for scientific accuracy means Kostis needed to figure out what the stars looked like from the imaginary camera's perspective on the date the data was gathered. She also needed to pinpoint the Sun's accurate position relative to those stars and the Earth. Kostis and colleagues Greg Shirah and Ernest Wright poured over star catalogs to place the star field correctly, and not only situated the Sun in the correct place, but ensured it correctly illuminated the Earth and created accurate shadows as well.

After two weeks of full-time work, Helen debuted the result—a slow arc toward our cloud-strewn world, flanked by the Sun and stars, revealed as if by an orbiting satellite or perhaps a spacecraft headed home.

The final view is both science and art. And it was captured not by a satellite, but by a scientific instrument infinitely more sophisticated—the human mind. ■

Taking On a New Position as Chief Financial Officer

By April C. Thornton

In March 2010, Julie Baker was appointed Chief Financial Officer (CFO) for NASA's Goddard Space Flight Center. Elated with the good news, Baker recollects 1978, when she began her career path at NASA.

Her career began as a Presidential Management Intern in the International Affairs Office at NASA Headquarters. As part of the intern program, she spent several months in NASA's Office of the Chief Financial Officer. It was this assignment that encouraged her to pursue this career further. "It was in line with my interest in space policy and it was clear that all of the work on the budget really drove what the Nation's space program was all about," Baker says.

Photo credit: NASA/Goddard/Pat Izzo

Caption: Julie Baker.

Baker has held various positions at NASA. While at NASA Headquarters she worked in the Office of the Chief Financial Officer from 1979 to 1998. She was a Program Analyst on the Space Science and Applications program, as well as the Space Shuttle program. In her last Headquarters position, she was involved in the Agency budget formulation process, where she was responsible for the material and the justifications for the Agency budgets requests sent forward to the Office of Management and Budget and the U.S. Congress.

In 1998, she came to Goddard to lead the Program Analysis Office in the Office of the Chief Financial Officer. She was accepted into the Senior Executive Service Candidate Development Program (SESCDP) in 2004. After completing the program in 2006, she was named Deputy Chief Financial Officer of Goddard.

When asked if she ever imagined becoming Chief Financial Officer when she arrived at Goddard, Baker says it was the furthest thought from her mind.

In her new position, Baker has goals that she wants to achieve as CFO. One of her top priorities is to support NASA's effort to receive a clean audit opinion. For the last 7 years, NASA has received a disclaimer opinion owing in large part to the transition to the integrated accounting system in 2003 and lack of detailed records for all the Agency's buildings and property.

Baker says, "The audit findings are important because they represent an independent assessment of the Agency's ability to document its business transactions—to ensure that proper controls are in place to prevent fraud and abuse, and to establish credibility that we are following proper rules of accounting standards."

To support the Agency's efforts, Goddard has focused on making sure our books are in good order, says Baker. She mentions that making progress towards a clean opinion is much more than just having proper accounting records. Baker says, "The audit opinion is a piece of establishing NASA's credibility with Congress and the American taxpayer that entrusting the Agency with taxpayer dollars is a wise investment."

Baker has words of encouragement for individuals who would like to follow her same career path. She advises anyone interested in resources and finance work to purse a wide variety of opportunities, so they can witness how different organizations work together. This kind of exposure will likely open doors to other opportunities.

Individuals may argue that the resources and finance world is dominated by men, but Baker strongly disagrees. Baker believes that the willingness to work hard and being open to a wide variety of experiences plays a vital role in people's ability to attain these positions. With positive thinking and aiming for greatness, Baker has reiterated these words of encouragement throughout her success. "Do what you love and love what you do," Baker says. She says that even though demands might be extensive, when you're doing what you love, it gives you the energy and focus to keep pushing through. ■

OutsideGoddard: an Interview with John Mather

By Elizabeth M. Jarrell

Photo credit: NASA

Caption: John Mather

Elizabeth M. Jarrell got some insight from Goddard's Dr. John C. Mather (JCM) into the man behind the Nobel Prize.

Winning the Prize

EMJ: What were your first thoughts on hearing that you had won?

John C. Mather (JCM): Wow! Our team will be very proud! My life has just changed completely! I have a new challenge and a new opportunity. I am now a public figure. I may never have another quiet moment.

Elizabeth M. Jarrell (EMJ): What were your wife's first words to you?

JCM: To tell you the truth I no longer remember what was first. But I do know she was wondering what she would wear to meet the King.

EMJ: So now that some time has passed, what are your first thoughts when someone mentions that you won the Nobel Prize?

JCM: I still want people to know that it was our whole COBE (*Cosmic Background Explorer*) team that earned that prize! Scientists, engineers, technicians (they're the ones who actually put the COBE together), the entire team.

Mentoring

EMJ: You have said that Mike Hauser was your main mentor and one of your greatest heroes. Why? What did he teach you about being a mentor and a hero?

JCM: I have tremendous admiration for his way of thinking. He is capable of seeing the big picture and then zooming in to check that the details are okay too. He is scrupulous about making sure that people are well organized and that they get proper recognition and credit for their work. He is generous with his time and he is willing to put aside his own research to enable other people to do great things with him. And on a personal note he is always somebody I can ask for advice.

Mike's mentoring was basically to give me a huge job and check in with me about what I needed to keep on going, to check my thinking. He was always available when I needed to ask a question and he didn't try to do my job for me. And of course mentoring is also done by example, but it's hard to capture the particular ways of being that get absorbed.

EMJ: What is the difference between being a mentor and being a hero?

JCM: A mentor enables a person to achieve. A hero shows what achievement looks like.

EMJ: How do you choose whom you will mentor directly?

JCM: They turn up and ask! And I say yes.

Speakers Circuit

EMJ: Are you now asked to give more public lectures and in more distant places?

JCM: Yes, almost every day I get a request to speak somewhere.

EMJ: With all these requests to lecture, how do you decide which lectures to deliver?

JCM: If it's within an hour of home I usually say yes, otherwise I have to have a personal reason to want to go. If my wife wants to accompany me, that's a real plus.

Continued Motivation

EMJ: How have the additional demands for mentoring and lecturing impacted your work as a physicist?

JCM: My work at NASA has always been about team efforts and so it's intrinsically about mentoring. I have been blessed with some brilliant colleagues who were able to take on huge challenges without a lot of guidance.

EMJ: Now that you have achieved the ultimate success in your field, what motivates you to continue working?

Continued on Page 11

OutsideGoddard: an Interview with John Mather

Continued from Page 10

JCM: I don't know about Olympic athletes but I don't think any of my scientific colleagues are motivated by trying to win or being the best. We do need recognition so we can be chosen to pursue our ideas, when we write proposals or conceive of new missions. But the competition is mostly not personal. It's more about the pleasure of pursuit, the satisfaction of discovery, and the opportunity to make a real contribution to knowledge. And I think many of the same factors apply to all the members of our team. We didn't work so hard to "be the best," we did it because we loved our work and it was worth doing.

The Mather Foundation

EMJ: You received a significant amount of Nobel Prize money. You and your wife used most of the award money to fund the John and Jane Mather Foundation for Science and the Arts, which, together with The Henry Foundation, Inc., funded the John Mather Nobel Scholarships. The award includes the title "John Mather Nobel Scholar" and a $3,000 scientific travel grant good for two years. Can you please tell us about these foundations and scholarships? Why did you establish them? What is your overall goal for each of them?

JCM: Our aim was to give something back to the Goddard community. I never felt that the money was really mine; it was the team's money, and I thought about what they would want to do with it. The young people who have received these scholarships were summer interns at Goddard, and they have used the funds to visit graduate schools, to go to professional meetings, and so forth. But I think the recognition has great value for them too—it tells the world that they have accomplished something of value, and it helps open doors for them.

EMJ: What have some of the recipients accomplished?

JCM: That's a pretty big story. The recipients already accomplished great things at Goddard, that's why they are recipients. But I am not involved in the selection process; I just get to meet the winners.

EMJ: You also used part of your award to endow a Hertz Foundation Fellowship to support cosmologists and applied scientists in part because you received a Hertz Foundation Fellowship early in your career. Can you tell us about this Foundation and who have been some of the recipients?

JCM: The Fannie and John Hertz Foundation gave me a graduate school fellowship 40 years ago that enabled me to devote full time to my research program. It was also a competitive thing that said people really believed I was part of "America's Got Talent" in the science world. So it made a huge difference to the way I viewed myself and my future. The Hertz Foundation was started to help nurture America's top scientists and engineers, with a specific interest in defense of the country. So I wanted to give back a bit. Our donation was matched by Ray Sidney of Google, so it is now an endowed fellowship.

The first student to receive it is Floris van Breugel, now an engineering student at CalTech working on insect-like flight. He's extraordinarily creative and it's a privilege to follow his work. He's also a brilliant nature photographer. Google his name and you'll see some of his work.

Life

EMJ: You have been married to your wife Jane for almost 30 years. You have said that you were initially impressed by her because she was a ballet teacher but was also taking computer and math classes as an undergraduate. How would you describe a well-rounded education? How important is a well-rounded education?

JCM: I think a well-rounded education keeps us from being bored and boring! And Jane's education is totally different from mine. She had real-life education, like being a waitress in a Hungarian tavern, that I have never experienced. She worked in hospitals, art studios, the Federal Reserve Bank, and the Art Institute of Chicago, and she painted shower curtains and made store displays. And she's been on stage with the Bolshoi ballet, which I can only imagine. She also introduced me to the fascination of foreign travel.

EMJ: You have also said that you met your wife during one of many personal growth experiences that you undertook as part of your emotional education. What do you mean by emotional education? Can you tell us about some of these personal growth experiences?

JCM: I grew up in a rather isolated rural setting with few friends up close, and essentially nobody outside my immediate small family to talk with. So my strategy for survival was to wait until the day that I could escape and see the real world. Also, my family was not obviously affectionate, and certainly did not show a lot of interest in how other people were feeling. So a lot of things that would be second nature to people growing up in a large talkative family were not natural for me. I had to learn to be more open with people and to know how to show that I was interested in them.

In college I was a bit worried that even the faculty didn't seem to know how to get on—quite a lot of them were getting divorced. So I began looking around for things to do for my own emotional education. When I got to grad school in Berkeley, I went to an encounter group, and later on to the EST training, which was new, and I was introduced to that experience. I learned a lot there, especially about the value of not making excuses for myself or for other people, and I got to see that I had a lot more power in personal relationships than I had realized.

Then I went to my postdoc position in New York and saw an old girlfriend from college. She was teaching Re-Evaluation Counseling (Co-Counseling) so I took courses in that too. That can also be a very powerful emotional experience that loosens up one's viewpoint about other people and one's willingness to be open to them. My sister was inspired enough about this subject that she also became a teacher of it.

Continued on Page 12

OutsideGoddard: an Interview with John Mather

Continued from Page 11

EMJ: You enjoy travelling to see how ancient civilizations accomplished their engineering feats. Where have you been? What engineering feats most impressed you and why?

JCM: We've been to Italy, where one can see a slice of history from Pompeii to the glories of the Roman Empire to the Renaissance, and in Florence we even saw Galileo's telescope. We've been to Greece and to Egypt, where we've seen the Pyramids and the temples and the museums of ancient life. We've seen the Great Wall in China. We've seen Ephesus in Turkey, where we stood in the ancient Forum and the actors' changing rooms in the theater, and we walked down the main street and saw the restored library and the condominium shops. We've seen the standing stones in Brittany and we've seen Stonehenge and the mound from 3,000 B.C. at Newgrange in Ireland. We've seen Samarkand and Bukhara on the Silk Road in central Asia, and we've been to the five royal capitals of ancient Morocco. We've been to southern Africa where our species may have originated among the lions and the elephants. I wish there were tourist guides for people who want to know how the ancients built things. In my next life, maybe I'll write some of those books.

EMJ: You said in your Nobel Prize autobiography that a recurring theme for you is that "life is a team sport, and it matters who's on the team, and which team(s) one chooses to be on." Can you elaborate? Also, can you discuss how you choose who is on your team and which team you are on?

JCM: I think one is on many teams at the same time, and it's not so obvious which ones have been chosen and which are accidents of history. For instance, I was born into the team of people who do science-my dad and my mother's dad were both scientists. But at NASA it's very clear that our work is organized around projects, and we work together.

The COBE team built itself in many ways—I wasn't the one to do the recruiting, for instance—but the idea and the challenge enabled all of us to recruit top talent. When we explained we were going to measure the Big Bang, people wanted to be on the team. One man who joined our team when he could have earned twice as much working on a classified program.

And when we started up the *James Webb Space Telescope* (JWST) project, again the idea was attractive, we had support from the very top of NASA, and brilliant people wanted to work with us. Then of course real managers (not me) got to choose people and assign their tasks and make plans. These days on the JWST project, people walk down the hall and hear laughter coming out of senior staff meetings, and they say, "How can I work on that project?" I really enjoy the people who come to work with us.

Teamwork

EMJ: What do you do if you find that certain people do not work well on your team? Or that you are on the wrong team?

JCM: I haven't had to do much of that. Charlie Pellerin's book, "How NASA Builds Teams," explains how important it is to have people in the right place for their personalities. Some of us are better equipped to deal with some parts of a project than others. If a person is not in the right place in an organization, he or she won't be happy and neither will the organization.

EMJ: You said that one of your "biggest thrills" is "trying out wild ideas and hunting for ways to go far beyond anything ever done before." Why? Can you explain what goes through your head during this time?

JCM: The hunt for the eureka moment, the light bulb going off, the sudden enlightenment, some way to build new equipment that could make a spectacular measurement, has always been one of my greatest pleasures. Getting the universe itself to yield its secrets is even harder, but finding a way to make a measurement is a big step. When I was a sophomore in high school, sometimes I might lie awake all night thinking about how to prove a theorem in geometry. Finding a way to make a new measurement has the same kind of challenge and the same kind of reward. It's like getting to the end of a very tough crossword puzzle, except this time one is the author of the puzzle as well as the solver.

The Future

EMJ: What do you say to young people to inspire excitement in science?

JCM: At the World Science Festival, we said, "Science Rocks!!" There's a huge pleasure in working on puzzles that really matter to humanity, where a discovery or a calculation can open doors to a new reality, where there's a chance to find something to put in the library of human knowledge, that may stand for all time. And of course, there's also the chance to work with amazing people, wonderful friends and colleagues. People picture scientists as loners, but these days science is a very social thing.

EMJ: In thanking those who helped you, you said they maintained your "faith in humanity despite all the disappoints that happen." What would you say to a young person to help them maintain their faith in humanity?

JCM: It's important to know that all the accomplishments and all the challenges we face all come from the same source, the unlimited imagination and the unlimited possibilities. And each of us has something. I would want to see what that young person really wants to do, what he or she is really in love with. With that, there is no limit.

But every problem has a solution, which leads to another problem. It's the nature of life and the universe. That's another reason why scientists will always have something to do. So I'm not worried, even though I am well aware that most species on this planet have become extinct in rather short times, millions of years. Kids growing up today have so much to tell us, and so much energy. And their kids will too. ■